Copper Patterning Using Plasma Oxidation or Anodization

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A copper patterning method using plasma-assisted oxidation may offer an alternative to Damascene-CMP processes. This method is based upon two independent steps: plasma oxidation or anodization of copper and subsequent copper oxide removal. Plasma oxidation is the critical step in this process and requires a hard-mask that does not oxidize rapidly in a plasma; thus Si_3N_4 or Al is used as a mask material. The reaction products of this oxidation step are a combination of cuprous oxide (Cu_2O) and cupric oxide (CuO), which can be easily removed by acidic solutions in the oxide removal step. Important process parameters that influence the oxidation rate and the final copper pattern profile include plasma power, gas pressure, substrate temperature, and anodization voltage. This plasma-based process may be applicable to the fabrication of copper interconnect structures in the processing of advanced microelectronic devices.

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